Shakespeare on the brain, Vivaldi on the weather, and Darwin on docu-soap?

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The Bard on the Brain: Understanding the Mind Through the Art of Shakespeare and the Science of Brain Imaging by Paul M. Matthews and Jeffrey McQuain, University of Chicago Press, 2003. £21.99/$35.00 (192 pages) ISBN 0 97238 302 6

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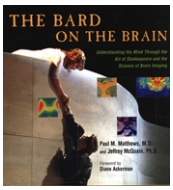

Like all great artists Shakespeare is universally credited with deep and eternal insights into the human soul. In *The Bard on the Brain*, Paul Matthews, a neurologist and director of the Oxford Centre for Functional Magnetic Imaging of the Brain, and Jeffrey McQuain, an author and researcher in literary studies have taken up the challenge to show how many of those insights are already substantiated by research in cognitive neuroscience using the recent technology allowing *in vivo* observation of brain activity.

Materials selected are grouped around seven themes with chapters like 'Minds and Brains', 'Decision and Action', 'Our Inner World', and 'Drugs and the Brain'. In each chapter the same recipe is used to obtain a colourful cocktail. Presentation consists of some initial introductory lines, followed by famous excerpts from well-known plays of the Bard and a selection of photographs showing actors at crucial turns in the dialogue together with artistic rendering of brain maps. Following the quotes are small essays of varying quality that try to build bridges between Shakespeare's words and the images of brain activation.

The selection of Chapter topics is naturally quite predictable, as the leading theme is the human condition. Similarly, the choice of passages quoted from each of the plays is in most cases not altogether that surprising. Unfortunately, in many cases the links are quite artificial and clumsy, and contain numerous clichés. In other cases the effort to present brain imaging on, say, bilingualism, numerical cognition, or language and semantics, overstretches the reader's imagination, because a direct relation to the big themes perceived in Shakespeare's plays – life, love, the passing of time and death – is certainly less than obvious.

Taking Shakespeare's work as the leading thread to explore the different themes that have been studied by 20th century neuroscientists is certainly an interesting approach, but a more thorough method than used here might have lead to something more interesting for readers at different levels. After having had a pleasant look through this book, we still wonder whether the attempt to try to bring arts and science closer together is really something that needs to be pursued. Nothing new really emerges from this side-by-side comparison; lovers of Shakespeare's work will not feel as though they gained new insights into his work, and scientists will not find any new useful information.

In a book that is devoted in part to '*the Science of Brain Imaging*' one would have hoped that the imaging techniques used to produce the illustrations of brain activation would be better introduced. Many of the figures were rendered in a way that might make them look better to some but also makes them very difficult to read and interpret. Moreover, a blatant mistake such as that in the caption of Figure 9, where what actually represents different visual areas is described as being brain activations for the left or the right visual field, is quite surprising.

Having looked at these images, the naïve reader could be left with the impression that these nice colored areas on the brain actually correspond to something to do with what Shakespeare says about the complexity and the subtlety of the human psyche. This would be more than a little misleading – we are actually a long way from this level of understanding in neuroscience, even if the progress towards it during the past decade has been amazing. Of course, there is an inherent danger of oversimplification in any book that tries to be accessible to a broad public. But the problems here run deeper. In fact, they are well enshrined in the title – was Shakespeare really interested in the brain? Or was it the mind he was after and was the brain a metaphor for the mind in Shakespeare's days, as it is in the present? This mind/brain confusion is quite apparent in some of the brain research quoted and the Shakespearean context in which it is presented here.

As much as the authors state that we are at the dawn of a new Enlightenment, it is not clear what the second Enlightenment is going to be about. The seamless transition from 'mind talk' to 'brain talk' brain opens up a gigantic can of worms that have neither been eradicated not metamorphosed into butterflies by the new brain imaging methods. In any event, the Bard did not say anything about the brain – his talk was all about the mind. Mind and brain can be used as synonyms of course, but does that mean any more in Shakespeare's day than it does now, other than that the brain is a metaphor for the mind?

None of this casts doubt on the impressive achievements of a decade of brain imaging research. An instructive comparison can be made with research on vision. There is no doubt that vision scientists have thrown light on some of the techniques used by painters and there is no denying that such research is much needed and very useful. But clarifying the perceptual basis of painting techniques and viewing a painting are two very different

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things. In the same sense Shakespeare is just as little about the brain as Vivaldi's *Four Seasons* is about the weather, as Malevich reveals about the spiritual depths of the Russian soul, or as Darwin contains scripts for docu-soaps.

In the end, what strikes us is that, in this book, Shakespeare's message is read for its factual meaning, that the metaphors are decoded as containing early sketches of knowledge awaiting long overdue confirmation from brain researchers. Surely it is hard to ignore that Shakespeare the playwright did not write these plays just to be read. Plays are conceived to be performed by actors and to be seen, heard and felt by an audience. Plays are not treatises on the soul, but scenarios for enacting emotions and for communicating with an audience in a theatre. The scenarios only come to life when embodied by actors and watched by agents. The book misses out on this aspect. But this is not to say that these aren't matters than can and will be taken up by scientists soon! In fact, one can easily imagine a brain imaging study in which the participants hear and see fragments of plays reprinted here. In that case, the next edition of this book would be accompanied with an interactive DVD that allows us to watch the play while seeing brain scans of participants' brain activity.

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Letter

Weighing up the facts of category-specific semantic deficits

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Caramazza and Mahon [1] discuss competing theoretical accounts of the organization of conceptual knowledge, in the light of evidence from patients with category-specific semantic deficits. They conclude that their 'Domain-Specific' hypothesis, in which evolutionary factors have resulted in specialized neural systems for concepts in a limited set of domains, namely animals, fruit and vegetables, conspecifics, and tools, is the only one that is consistent with the 'facts' of category-specific deficits. Although we agree that there are many problems for alternative theories and that none provides a complete account of the data, we wish to highlight a fact that is not mentioned by Caramazza and Mahon, but which presents a challenge to the Domain-Specific hypothesis [2,3].

The fact in question is that most patients with category-specific semantic deficits show a *graded* impairment rather than an all-or-none dissociation. That is, few patients are within the normal range for their 'preserved' category across all semantic tasks on which they are tested. In support of this point, we cite just a few illustrative cases – patients 'JBR' [4], 'Michelangelo' [5] and 'RC' [6] – but there are many more. The few cases for whom performance is consistently within the normal range for the preserved category – for example, 'EW' [7] – are the exception rather than the rule. How would graded impairments arise from a lesion to a distinct, dedicated neural system for a specific category or domain? One possibility is that the neural circuits are close together in the brain, so that large and/or diffuse lesions affect more than one system, but to differing degrees. However, this argument remains untestable unless precise claims are made about the neuro-anatomical correlates of the proposed domain specific systems. Although the lesion data show some broad correlations between bilateral antero-medial and inferior temporal lobe damage and living things deficits, there is much variation in the extent and location of lesions and the degree of impairment in 'preserved categories'. For example, patient 'EW' [7] has a highly selective deficit for animals – which we might expect to be associated with a small focal inferior temporal lobe lesion – yet she has a large area of encephlomalacia within the left posterior frontal and parietal lobes. Extensive fronto-parietal lesions are more commonly associated with artifact deficits.

A related point concerns the nature of dissociations in neural activity produced by concepts in different domains as revealed in functional imaging studies. Caramazza and Mahon cite evidence for category- or domain-specific activations in a number of imaging studies as further support for the Domain-Specific account. However, the regions of interest are rarely *selectively* recruited by a specific domain or category; rather, different categories produce activation across many of the same regions, but to different degrees [8]. Rather than separate systems dedicated to individual domains, this suggests that concepts within different domains place more or fewer processing demands on different elements within a single system [9]. A possible reply to this point is that the domain-specific neural system should be interpreted as arising from a network of connections within pools of neurons that are common to the processing of many domains, but then it is difficult to see how this differs from a unitary system in which category structure emerges as a function of overlap and correlation within concepts.

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